1 PHYSICAL EXAMINATION AND CLASSIFICATION OF FIREARMS

1.1 Introduction

All firearms must be treated as though they are loaded. This rule cannot be over stressed and must be followed at all times, whether it's in the evidence receiving area, firearm section, test firing area, or court. Safe firearm handling within the laboratory environment corresponds with safe firearm handling in general. The only way to prevent accidents is to practice safety at all times. Firearm evidence in the laboratory environment is not dangerous if handled correctly and treated with respect. Occasionally, loaded firearms are received in evidence for a particular examination. These, of course, need very special handling. It is the responsibility of the firearm examiner to ensure that all appropriate safety function checks are performed on a firearm or item of ammunition prior to test firing.

1.2 Safety Considerations

Examinations performed in the Firearm and Toolmark Section is inherently hazardous. These procedures involve hazardous chemicals, firearms, ammunition, and power tools. All hazardous procedures must be performed in compliance with the DFS Safety Manual.

1.3 Preparation of Cleaning Solutions

NOTE: ALWAYS ADD ACID TO WATER. NEVER ADD WATER TO ACID.

1.3.1 Acetic Acid Solution

- Prepare a 15% Acetic Acid Solution by combining 150 milliliters of Glacial Acetic Acid to 850 milliliters of distilled water
- Store solution in an appropriate, sealed container that is marked with the date and initials of the preparer
- Record in the Firearms Quality Record Book

1.3.2 Bleach Solution

- Prepare a Bleach Solution by combining 10 milliliters of bleach to 90 milliliters of distilled water
- Store solution in an appropriate, sealed container that is marked with the date and initials of the preparer
- Record in the Firearms Quality Record Book

1.4 Instrumentation

- Standard Trigger Weights
- As appropriate for length measurements: Ruler (and/or) Tape Measure (and/or) Non-marring object, such as a dowel
- Scale/Balance
- Stereo Microscope
- Decibel Meter, silencer testing
- Protractor, ejection pattern analysis
- Rubber mat and Durometer, drop testing

1.5 Minimum Analytical Standards and Controls

Appendix – A

1.6 Procedure or Analysis

The evidence will be marked in accordance with the Quality Manual. A systematic approach should be used for the physical examination and classification of firearms, with recording of findings and observations in examiner's case notes.

1.6.1 Safe Firearm Handling

- The muzzle of the firearm must always be pointed in a safe direction
- Firearms submitted to the laboratory for examination should be unloaded and in a safe condition
- Test firing or any examination of the firearm that utilizes ammunition or an ammunition component, will only be performed in designated test firing areas
- A firearm will not be placed in the evidence room or returned to any agency in a loaded condition

1.6.2 General, Visual, and Physical Examination

1.6.2.1 Firearm/ammunition submitted without request for comparison

The initial examination of a firearm submitted without request for comparison will include a Firearm Worksheet C-14. This worksheet will include the manufacturer's data of the firearm and will serve as a source to document the condition of the firearm as received. Further information will be added to the worksheet as tests are performed.

Visual and physical examinations are conducted to determine the following firearm features, to be recorded on Firearm Worksheet C-14:

- Caliber/Gauge
- Make/Model
- Importer
- Serial number and location
- Firing mechanics
- Type of action
- Safeties, and operability
- Operating condition
- Rifling characteristics

The number of cartridges/shotshells will be noted and no other examinations will be conducted on these items.

1.6.2.2 Firearms submitted with request for comparison

The initial examination of a firearm submitted with request for comparison will include a Firearm Worksheet C-1. This worksheet will include the manufacturer's data of the firearm and will serve as a source to document the condition of the firearm as received. Further information will be added to the worksheet as tests are performed.

Examine the firearm visually and microscopically for any trace material. Determine if further examination of trace material is necessary and consult the appropriate discipline prior to the removal of any trace evidence. Document findings and observations and record in the notes.

Once the firearm has been examined for the presence of pertinent trace evidence material, visual and physical examinations are conducted to determine the following firearm features, to be recorded on the firearm worksheet:

- Caliber/Gauge
- Make/Model
- Importer
- Serial number and location
- Firing mechanics
- Type of action
- Safeties, and operability
- Operating condition
- Trigger pull
- Rifling characteristics
- Barrel length
- Overall length

1.6.3 Trace Material Examination

Evidence recovered during an investigation may contain trace material transferred from the crime scene. This trace material may be in the form of blood, tissue, plaster, paint, hairs, fibers, glass, etc. The examiner needs to evaluate the importance of this evidence, and if further examination of the material is necessary, remove and preserve a sample of the material present. Removal of material may also be necessary to allow the proper examination of the evidence.

- Remove material being careful not to damage the evidence

- Place the removed material into a suitable container/packaging for possible submission for further examination
- Record findings and observations in the notes

If the material IS NOT going to be retained for further examination, proceed with the following:

- For evidence containing blood, tissue, or other biohazards, soak or sonicate the evidence for at least one (1) minute in a Bleach Solution (refer to 1.3)
- Remove loosened material by rinsing with methanol or water
- Remove plaster by soaking in a 15% Acetic Acid Solution (refer to 1.3)
- Remove paint by soaking in alcohol or acetone
- Use a non-abrasive brush to remove loose material
- Use Naval Jelly or E-zest coin cleaner to removed dark stains as needed
- Record findings and observations in the notes

1.6.4 Pre-Firing Safety Examination

A visual examination of firearm prior to test firing is needed to determine:

- Obstruction in the bore
- Signs of cracks or weaknesses in major parts of frame, slide, or barrel
- Overall mechanism functioning
- Type of ammunition appropriate for use with firearm
- Suitability of evidence ammunition submitted for test firing

- Soundness of chamber/barrel, condition of percussion nipples, existing load in chamber (muzzleloaders)
- If firearm should be test fired remotely due to unsafe firearm condition
- Record findings and observations in the notes

1.6.5 Trigger-Pull Examination – Standard Trigger Weights

One of the routine examinations conducted in a firearm identification examination is determining the trigger pull of a firearm. Trigger pull is defined as the amount of force, which must be applied to the trigger of a firearm to cause sear release. This examination can provide vital information regarding the mechanical operating condition of the firearm. The trigger pull of a firearm can be obtained utilizing standard trigger weights, which make contact with the trigger at a point where the trigger finger would normally rest.

1.6.5.1 Single-Action Trigger Pull

- Insure that the firearm is unloaded
- Measuring the trigger pull of a rimfire firearm should not be performed on an empty chamber
- A fired cartridge case or “dummy” cartridge should be used to measure the trigger pull of a rimfire firearm
- Consider the potential for damage of a centerfire firearm and the use of a fired cartridge case or “dummy” cartridge
- Cock the firearm
- Hold the firearm with the muzzle vertical
- Rest the trigger hook of the standard trigger weight hanger on the trigger where an average finger would normally rest, making sure it is not touching any other part of the firearm
- Weights should be hanging parallel to the bore of the firearm
- Recock the firearm
- Add weight until the sear releases

- Note the weight at which the sear releases
- Reset the sear connection after each attempt
- Record the lightest weight necessary for sear release
- Record findings and observations in the notes

1.6.5.2 Double-Action Trigger Pull

- Insure that the firearm is unloaded
- Measuring the trigger pull of a rimfire firearm should not be performed on an empty chamber
- A fired cartridge case or “dummy” cartridge should be used to measure the trigger pull of a rimfire firearm
- Consider the potential for damage of a centerfire firearm and the use of a fired cartridge case or “dummy” cartridge
- Hold the firearm with the muzzle vertical
- Rest the trigger hook of the standard trigger weight hanger on the trigger where the average finger would normally rest, making sure it is not touching any other part of the firearm
- Weights should be hanging parallel to the bore of the firearm
- Add weight until the weight pulls the trigger through the double-action sequence and the sear releases
- Note the weight at which the sear releases
- Reset the sear connection after each attempt
- Record the lightest weight necessary for sear release
- Note any revolver cylinder chamber that differs from the lightest weight recorded

- Record findings and observations in the notes

1.6.5.3 Interpretation of Results

The results acquired are only an approximation and a different technique may lead to a different trigger-pull weight. The trigger pull is normally recorded to the nearest one-fourth (1/4) pound. Record the interpretation of results in notes.

1.6.5.4 Reporting Format

Suggested format for reporting firearm function and trigger pull examinations:

The item __ pistol/revolver/rifle/shotgun was examined and found to be in mechanical operating condition with the safety features functioning properly and test fired.

The trigger pull of the item __ pistol/revolver/rifle/shotgun was determined to be approximately three and one-half (3 ½) pounds single-action and fourteen (14) pounds double-action.

As received, the item __ pistol/revolver/rifle/shotgun does not function because of a missing _____. Part(s) from a reference firearm were used to replace the missing part(s) in item ___. The item ___ pistol/revolver/rifle/shotgun was then test fired.

1.6.6 Barrel and Overall Length Measuring

One of the routine procedures conducted in a firearm identification examination is determining the barrel length and in some cases the overall length of a firearm. Barrel length is defined as the distance between the end of the barrel and the face of the closed breechblock or bolt for firearms other than revolvers. On revolvers, it is the

overall length of the barrel including the threaded portion within the frame. Barrel length normally should include compensators, flash hiders, or any other permanently affixed attachments to the muzzle of a firearm. Overall length of a firearm is defined as the dimension measured parallel to the axis of the bore from muzzle to a line at right angles to the axis and tangent at the rearmost point of the butt plate or grip. Removable barrel

extensions, poly chokes, flash hiders, etc., are not included when measuring the barrel length or overall length; however, this measurement should include any permanently affixed attachments.

Care must be taken if any object is placed down the barrel to determine the barrel length. A non-marring item should be used for making internal measurements. All measurements are made and recorded in inches to nearest 1/16 inch.

1.6.6.1 Barrel Length

Revolvers:

Measure the distance from the breech end of the barrel to the muzzle. Do not include the cylinder. This measurement is usually performed externally on the firearm. It can be made internally by placing a non-marring item down the barrel of the firearm, marking the item at the muzzle and at the forcing cone, extracting it and then measuring the marked length.

Firearms Other Than Revolvers:

Measure the distance from the breech face in a closed and locked position to the muzzle

either externally or internally. Assure that the firing pin is not protruding through the firing pin hole by cocking the mechanism. This measurement is performed internally by placing a non-marring item down the barrel of the firearm flush to the breech face, marking it at the muzzle end, extracting it and measuring the marked length. The distance from the closed and locked breech end to the muzzle would be the measurement of the barrel of the firearm.

1.6.6.2 Overall Length

Measure the distance from the butt to the muzzle, parallel to the bore.

1.6.6.3 Interpretation of Results

All measurements should be considered approximations based on the device used to obtain the measurements, and record the findings in the notes.

1.6.6.4 Reporting Formats

Suggested format for the reporting of a shotgun with a shortened barrel:

Examination of the item __ shotgun revealed it to be in mechanical operating condition with the safety feature(s) functioning properly and test fired. The barrel of this shotgun has been shortened to an approximate length of _____ inches. The stock has also been shortened making the overall length approximately _____ inches. The item __ shotgun is a smooth bore firearm originally designed to be fired from the shoulder and is capable of firing, with a single function of the firing device, a projectile of approximately ___ caliber or shotshells containing various pellet loads.

1.6.7 Test Firing

Test firing recovery methods include the water tank, the cotton-waste recovery box, the Detroit bullet trap, the snail system, and the bullet-trap range. The type of firearm and ammunition tested will usually dictate the type of recovery method used. In order to perform a microscopic comparison of a submitted firearm, a minimum of two (2) test shots should be fired and recovered. Other test-fire procedures include downloading ammunition, and firing primed cartridges or shotshells.

1.6.7.1 Safety Considerations

All firearms must be treated as though they are loaded. This rule cannot be over stressed and must be followed at all times, whether it's in the evidence receiving area, firearm section, test firing area, or court. Safe firearm handling within the laboratory environment corresponds with safe firearm handling in general. It is the responsibility of the firearm examiner to ensure that all appropriate safety function checks are performed on a firearm or item of ammunition prior to test firing. Appropriate hearing and eye protection must be used. The examiner should be aware of the maximum velocity of the projectile that can be fired into a particular water tank or bullet trap, as well as the proper water depth needed for firing. Due to the potential hazard of the firearm malfunctioning or undergoing a catastrophic failure during remote firing, the examiner should be stationed behind a protective shield or at a safe distance from the firearm when discharging the firearm.

1.6.7.2 Water Recovery Tank

The water recovery tank is usually used to recover bullets from handguns, rifles, and slugs fired from shotguns. The cotton-waste recovery box utilizes similar procedures.

- The recovered test-fired components will be marked in accordance with the Quality Manual
- The examiner should consider indexing and sequencing each shot
- Proper hearing and eye protection must be worn
- Ensure that the water level in the bullet recovery tank is appropriate
- Ensure that all lids or doors of the bullet recovery tank are closed and properly secured
- Ensure that the exhaust fan or system is turned on
- Ensure all warning systems are activated
- Check the barrel for obstructions before each firing
- The examiner should load no more than two (2) cartridges/shotshells into the firearm during the initial testing of the firearm
- Test firing into the bullet recovery system will be done with the muzzle of the firearm inserted into the shooting tube so that any discharge from the muzzle will be captured within the recovery tank
- Recover the bullets using an appropriate device
- Ejected, fired cartridge cases/shotshell cases must be retrieved
- Record findings and observations in the notes

1.6.7.3 Bullet-Trap Range

The bullet trap is usually used to test fire firearms when the recovery of the fired projectile(s) is not necessary. The Detroit bullet trap and the snail system utilize the same procedures.

- The recovered test-fired components will be marked in accordance with the Quality Manual
- The examiner should consider indexing and sequencing each shot
- Proper hearing and eye protection must be worn
- Ensure that the exhaust fan or system is turned on

- Ensure all warning systems are activated
- Check the barrel for obstructions before each firing
- The examiner should load no more than two (2) cartridges/shotshells into the firearm during the initial testing of the firearm
- Fire the firearm into the front of the range trap
- Ejected cartridge cases/shotshell cases must be retrieved
- Record findings and observations in the notes

1.6.7.4 Remote Firing

During the course of examining a firearm, it may be determined that it would be unsafe for the examiner to fire the firearm by holding it as designed. If it is necessary to obtain test standards from this firearm, the firearm should be fired remotely. The Zero-One® (or a similar device) can be utilized for firing long arms and some handguns, while the Ransom Rest® (or a similar device) can be utilized for firing handguns.

- The recovered test-fired components will be marked in accordance with the Quality Manual
- Check the barrel for obstructions before each firing
- The examiner should consider indexing and sequencing each shot
- Proper hearing and eye protection must be worn
- Set up the chosen remote-firing device in front of the appropriate recovery system, as per guidelines set forth by the device manufacturer

- Place firearm in device
- Dry-fire the firearm in the remote firing device before using ammunition
- Ensure that the exhaust fan or system is turned on
- Ensure that all warning systems are activated
- The examiner should load no more than one (1) cartridge/shotshell into the firearm during the initial testing of the firearm
- Activate the remote device while standing behind a protective shield or at a safe distance away from the firearm
- Pull the string that is attached to the trigger that will cause the firearm to function
- Retrieve the test-fired components
- Record findings and observations in the notes

1.6.7.5 Downloading Ammunition

It may be necessary to reduce the powder load of the cartridge in order to obtain a velocity suitable for safely collecting test-fired components for comparison purposes. Even with a reduced load, it may be necessary to fire the firearm remotely.

- Remove the bullet from the cartridge using an inertia bullet puller or a reloading press
- Remove existing powder from the cartridge
- Weigh the pulled bullet
- Consult a reloading manual, such as Lyman, to determine the powder charge for the weight of the pulled bullet, to determine the velocity requirement for safe test firing
- Weigh the powder in accordance with the velocity requirement
- Reload the cartridge with weighed powder that is not less than 30% of the original weight
- Loosely pack a small piece of tissue or other similar material into the cartridge case to fill the gap between the bullet and powder
- Seat the bullet back into the cartridge case using a rubber mallet or a reloading press

- 50% downloading CANNOT be used with slow burning powders
- 50% downloading CANNOT be used with many non-canister powders
- Check the barrel for obstructions before each firing
- The ammunition components of each test shot should be marked in accordance with the Quality Manual
- Record findings and observations in the notes

1-6.7.6 Primed Cartridge/Shotshell

During the course of examining a firearm, it may be determined that it would be unsafe for the examiner to fire the firearm as designed. If it is not necessary to obtain test-fired components for comparison purposes, the firing condition of the firearm can be tested using a primed, empty cartridge case or shotshell case.

- Obtain a primed empty cartridge case in the desired caliber or pull the bullet of a cartridge using an inertia bullet puller or reloading press, retaining only the primed cartridge case
- For shotguns, obtain a primed empty shotshell in the desired gauge or cut open a shotshell removing all components, retaining only the primed shotshell
- A commercial firing pin testing device may be used
- Proper hearing and eye protection must be worn
- Ensure that the exhaust fan or system is turned on
- Ensure that all warning systems are activated

- Check the barrel for obstructions before each firing
- Load the primed, empty cartridge case, primed, empty shotshell, or a commercial firing pin testing device into the chamber of the firearm and test fire in front of the bullet trap
- When utilizing a primed, empty cartridge/shotshell, it is imperative to check the barrel for obstruction before each test fire
- Repeat if the firearm has more than one action
- Retrieve all test-fired components
- Record finding and observation in the notes

1.6.7.7 Disposition of Test Fires

Tests may be produced from submitted evidence ammunition or laboratory stock ammunition. The tests shall be marked with unique identifiers including, when possible, the initials of personnel examining/processing the tests, the laboratory number, and the appropriate item number.

Tests made from submitted evidence ammunition shall remain evidence.

Tests made from stock laboratory ammunition are considered reference material. They will be sealed and returned with the firearm which generated the tests or will be retained in the laboratory for reference or training purposes. Tests retained at the laboratory should not subsequently be used for any identification purposes.

Disposition of tests produce from submitted evidence ammunition will be reported in the Certificate Analysis as follows:

> [number ( )] of the item [ ] cartridges/shotshells were used for test firing purposes. The resultant ammunition components are being returned with the other evidence and should be maintained for possible future examinations.

Disposition of tests produced from laboratory stock ammunition will be reported in the Certificate of Analysis as follows:

> [number ( )] cartridges/shotshells from laboratory stock ammunition were used for test firing purposes. The resultant ammunition components are being returned with the evidence and should be maintained for possible future examinations.

1.6.8 Rusty Firearm Examination

Rusty firearms or those found in water, etc. may be submitted for examination. Immediate attention must be given to these firearms to prevent further damage to the firearm. The examiner should instruct the agency that recovers the firearm to submit the firearm in a container of the fluid in which the firearm was found. If this is not practical, the agency can be instructed to immediately and thoroughly spray the firearm with a water-displacing product such as WD-40® or other similar product to prevent further deterioration. It should be noted that the firearm might be too rusted to be functional.

An examiner must take all necessary precautions to insure that the firearm is unloaded. If it cannot be readily verified as being unloaded, it must be examined in an area designated for the firing of firearms. Determining whether or not a firearm is unloaded may necessitate a complete disassembly, or, in some cases, destruction (e.g. cutting).

The evidence will be marked in accordance with the Quality Manual.

- Determine to what extent restoring the firearm is possible (i.e., for test firing, for recovering manufacturer information, serial number, etc.)
- Soak the firearm in penetrating oil, de-rusting solvents, or similar material to dissolve rust
- Periodically check the firearm until the firearm functions, or the desired information is recovered
- Clean the firearm with gun cleaning solvent, cleaning patches, and cloth (only a non-marring item should be used down the barrel of a firearm)
- Record findings and observations in the notes

1.6.9 Sound Suppressor Examination

A silencer or sound suppressor is any device designed to reduce the noise of discharge that is attached to the barrel of a firearm. Silencers can be commercially produced or homemade. They are typically tubular metal devices, but may vary in shape or form. The evidence will be marked in accordance with the Quality Manual. A systematic approach should be used for the sound suppression examination, with recording of findings and observations in the notes.

- Examine device to determine if it is, or is characteristic of, a silencer or sound suppression device
- Check the barrel for obstructions before each firing
- A noticeable reduction in sound between the firing of the firearm with the device attached vs. the firing of the firearm without the device is sufficient to determine that the device is a sound suppressor
- An appropriate sound level measuring device can be used, such as a decibel meter (follow manufacturer instructions for use)
- Testing of a firearm and firearm/silencer combination must be conducted in an appropriate setting, usually a firing range
- Multiple readings should be taken, both with and without the silencer affixed to the firearm
- Record findings and observations in the notes

1.6.10 Malfunctioning Firearm Examination

A firearm examiner may be called upon to examine a firearm to determine if the firearm will malfunction. Many of these cases will deal with the question: "Will the firearm fire without pulling the

trigger?" In these instances it should be the goal of the examiner to acquire a detailed account of the incident, followed by a thorough examination and testing of the firearm. Examinations may include external and internal observations, x-ray, and striking or dropping the firearm in attempts to duplicate the incident as reported. The examiner should attempt to conduct examinations in a manner so as not to alter the firearm. However, there may be occasions when damage may occur. Any change to the firearm should be specifically documented in the examiner's notes. A systematic approach should be used for the malfunctioning firearm examination, with recording of all findings and observations. No one procedure can sufficiently outline the steps necessary to examine all firearms for any malfunction. The following list of examinations should serve as a ***guideline***.

1.6.10.1 Visual Condition of Firearm as Received

- Cocked/uncocked
- Safety position
- Loaded/unloaded
- Cartridge position
- Stuck cartridge/discharged cartridge cases
- Presence and/or location of flares

1.6.10.2 Visual abnormalities

- Barrel (loose, damaged etc.)
- Receiver (condition)
- Slide (condition)
- Parts broken or missing (firing pin, ejector, extractor)
- Screws (loose or missing)
- Alterations or adaptations
- Sights
- If the firearm is to be x-rayed, it should take place prior to disassembly

1.6.10.3 Action – External

- Relationships of the action parts
- Correct assembly
- The proper locking of the action on closing
- Cylinder rotation (securely locks)
- Hand relationship to the ratchet
- Trigger (not returning, sticks, broken spring, etc.)
- Trigger pull (single action, double action) and striking of hammer

1.6.10.4 Safeties

- ¼, ½, full cock, seating check (any false seating positions, pull off/push off, etc.)
- Function (grip, magazine, disconnector)
- Rebound hammer or inertia firing pin
- Firing pin (relationship to primer, condition)

- Drop hammer several times to check safeties
- Position of the slide or bolt in order to fire
- Condition of safeties

1.6.10.5 Action Check

- Check feeding of magazine (lips, follower), carrier or lifter, and feed ramp
- Slamfire
- Extractor and/or ejector markings on evidence cartridges/discharged cartridge cases
- Marks exhibited on the cartridges/discharged cartridge cases
- Check for any inherent “quirks” known about the particular firearm based on literature or case data

1.6.10.6 Test Fire Firearm

- Note any operational problems
- Check the barrel for obstructions before each firing
- Misfires
- Ammunition involved (proper cartridge, type, reloads, etc.)
- Check consistency of the impression on test-fired components and evidence

1.6.10.7 Special Situational Tests

The force to be used in testing could alter or damage internal parts and their working relationship(s). Firearms that are received in a damaged condition may require special situational tests, which may require more force than normal for an examination. Care should be exercised when testing a firearm to minimize examiner-caused damage that could prevent the determination of the cause of the reported malfunction.

1.6.10.8 Action - Internal

- Hammer notches (worn, burrs, dirt, etc.)
- Sear (worn, broken, burrs, etc.)
- Safeties (relationships and general parts relationship)
- Springs (weak, broken, altered, etc.)
- Signs of any tampering or faulty assembly

1.6.11 Bore/Chamber Casting

Occasionally, firearms are received for which the caliber may not be known or may be different than is designated on the firearm and in the industry literature. In order to facilitate firing of test shots that are the correct caliber for a particular firearm, it may be necessary to make a bore and/or chamber cast. By measuring the cast, the correct cartridge can be determined for test firing. Casts can be made using various casting materials such as low melting point metals and silicone rubber compounds. The procedure below is for Mikrosil®, Espe Impregum® and Cerrosafe®.

- Insure that the firearm is not loaded
- Open the action and remove the bolt or bolt assembly
- Check the bore for obstruction
- Push a cleaning patch in the barrel, from muzzle end, until it is ½ inch to ¼ inch from the beginning of the chamber

- Lubricate the chamber with gun oil, a silicone spray, or some other similar substance such as WD40®
- Mix Mikrosil® or Espe Impregum® as per manufacturer instructions or melt Cerrosafe® and pour into the chamber until full

- Do not allow casting material to flow into breech as it will make extraction of the cast difficult
- When casting material is set or cool, depending on type used, gently tap end of cleaning rod to loosen the cast from the chamber and then remove the cast from the breech end
- If a Cerrosafe® cast cannot be loosened from the chamber, then the cast can be melted out of the barrel by heating
- Remove the stock from the firearm and place the breech end in a large container of water
- Heat to just above its melting temperature
- Cerrosafe® can be reused
- Mikrosil® and Espe Impregum® has to be pushed or forced out of the chamber and is not reusable
- Use the same steps for casting the bore, but only the last three (3) inches of the bore need to be cast
- Record findings and observations in the notes

1.6.11.1 Interpretation of Results

The correct caliber of the firearm can be determined by measuring the mouth, base, overall length, rim (if pertinent), shoulder length of the chamber cast, or the diameter of the bore cast. Record the interpretation of results in the notes.

1.6.12 Drop-Test Procedures

This Voluntary Industry Performance Standard provides the firearm designer and manufacturer with recommendations for test procedures to evaluate new designs of rifles, shotguns, and handguns as they are defined by the Federal Gun Control Act of 1968. The test parameters simulate conditions where the firearm is subjected to abusive mishandling to demonstrate the ability of the firearm to withstand this abuse without discharging. This Standard does not apply to muzzle-loading and black-powder firearms of any type. The requirements of this Standard are not appropriate for firearms primarily intended for formal target shooting; and therefore, this Standard does not apply to firearms whose trigger pull is designed to be less than three pounds. A systematic approach should be used for the drop, exposed hammer, jar-off, and rotation testing, with recording of findings and observations in examiner's notes using one or a combination of the following tests. The test should be conducted with firearm as received and the same firearm should be used throughout the test.

1.6.12.1 Drop Test

- With the firearm in the "safe carrying" condition, the firearm should be capable of passing the below test criteria for drop testing from a height of 48 inches onto a 85 +/- 5 Durometer (Shore A) rubber mat, one inch thick, on a concrete floor
- The mat and concrete should be large enough so that when the gun is dropped it will fall and come to rest without interference within the perimeter of the mat
- The drop height should be measured from the surface of the rubber mat to the center of gravity of the firearm
- The center of gravity should be determined to an accuracy of +/- one inch by any recognized method for finding the center of gravity of an irregular shaped object
- The firearm should be recocked and reset in the "safe carrying" condition after each drop
- The firearm should not fire a chambered, empty-primed case of its designated caliber/gauge when tested in accordance with this procedure (firing indicates a malfunction)
- In a multi-chambered gun the primed case should be inserted in each chamber directly in front of its firing pin
- Check the barrel for obstructions before each firing
- Parts breakage or other damage resulting from drop testing does not constitute failure as long as the empty primed case does not fire and the firearm can be unloaded safely after each drop
- The firearm should be dropped in such a way as to cause it to strike the rubber mat in each of the following attitudes:

  Barrel vertical, muzzle down
  Barrel vertical, muzzle up
  Barrel horizontal, bottom up
  Barrel horizontal, bottom down
  Barrel horizontal, left side up
  Barrel horizontal, right side up

- The magazine, clip, or remaining revolver cylinder chambers should be fully loaded with dummy cartridges/shotshells
- The firearm should not fire a chambered, empty primed case of its designated caliber/gauge when tested according to this procedure (firing indicates a malfunction)
- The firearm should be of minimum and maximum weight configurations for a given model including weight variations introduced by accessories catalogued by the manufacturer
- Record findings and observations in the notes

1.6.12.2 Exposed Hammer Test

Handguns with exposed hammers or strikers should be capable of passing the following test criteria with the firearm in the "safe carrying" condition. The test should be conducted with firearm as received and the same firearm should be used throughout the test.

- The firearm should be dropped the specified distance with the barrel vertical and muzzle up, striking the rear of the hammer spur or exposed striker upon a mild steel block of at least fifty pounds weight
- Instead of dropping the firearm, a mild steel weight equal to the weight of a fully-loaded firearm with accessories as catalogued by the manufacturer may be substituted
- The steel weight may be dropped the specified distance, striking the exposed hammer or striker with the firearm held with barrel vertical and muzzle down, its muzzle resting on a mild steel block of at least fifty pounds weight
- Check the barrel for obstructions before each firing
- The firearm should not fire a chambered, empty primed case of its designated caliber/gauge when tested according to this procedure (firing indicates a malfunction)
- In the case of a multi-chambered gun, a primed case should be in each chamber directly in front of its firing pin
- If at any time during the test there is observable damage to a part of the firearm without the firing of the primed case, the part may be replaced and the test continued, unless the damaged part bears the serial number of the firearm
- Damage to the serial numbered part without discharge of the primed case after all drop tests should not constitute failure of this test, as long as the firearm can be unloaded safely after each drop
- The drop height for handguns should be 36 inches
- The height should be measured from the impact surface to the contact point on the exposed hammer of the firearm
- The magazine, clip, or remaining revolver cylinder chambers should be fully loaded with the dummy cartridges and locked in place
- The firearm should be of minimum and maximum weight configurations for a given model, including weight variations introduced by accessories catalogued by the manufacturer
- Record findings and observations in the notes

1.6.12.3 Jar-off Test

With the firearm cocked and in the ready-to-fire condition (safety off) the firearm should be capable of passing a jar-off, shock equivalent to being dropped from a height of 12 inches onto a 85 +/- 5 Durometer (Shore A) rubber mat, one inch thick on a concrete floor. The test should be conducted with firearm as received and the same firearm should be used throughout the test.

- The mat and concrete should be large enough so that when the gun is dropped it will fall completely within the perimeter of the mat
- The drop height should be measured from the surface of the rubber mat to the lowest point on the firearm
- The gun should be caught after its first bounce from the mat so that it strikes the mat only one time
- Check the barrel for obstructions before each firing
- The firearm should be recocked and reset in the ready-to-fire condition after each drop
- The firearm should not fire a chambered, empty primed case of its designated caliber/gauge when tested in accordance with this procedure (firing indicates a malfunction)
- In the case of a multi-chambered gun, a primed case should be in each chamber directly in front of its respective firing pin

- Parts breakage or other damage resulting from drop testing does not constitute failure as long as the empty primed case does not fire and the firearm can be unloaded safely after each drop
- The firearm should be dropped in such a way as to cause it to strike the rubber mat one time only in each of the following attitudes:

  Barrel vertical, muzzle down
  Barrel vertical, muzzle up
  Barrel horizontal, bottom up
  Barrel horizontal, bottom down
  Barrel horizontal, left side up
  Barrel horizontal, right side up

- The magazine, clip, or remaining revolver cylinder chambers should be fully loaded with dummy cartridges/shotshells
- The firearm should be of minimum and maximum weight configuration for a given model, including weight variations introduced by accessories catalogued by the manufacturer
- Record findings and observations in notes

1.6.12.4 Rotation Test

The rifle or shotgun should be in the "safe carrying" condition. The firearm should be capable of passing the test criteria when allowed to fall freely from an upright position with its butt resting on the surface of a 85 +/- 5 Durometer (Shore A) rubber mat, one inch thick on a concrete floor. The mat backed by concrete should be large enough so that when the gun is dropped it will fall and come to rest without interference within the perimeter of the mat. The test should be conducted with firearm as received and the same firearm should be used throughout the test.

- The firearm should be recocked and reset to the "safe carrying " condition after each drop
- Check the barrel for obstructions before each firing
- The firearm should not fire a chambered, empty primed case of its designated caliber/gauge when tested in accordance with this procedure (firing indicates a malfunction)
- In a multi-chambered gun the primed case should be inserted in each chamber directly in front of the firing pin
- Parts breakage or other damage resulting from drop testing does not constitute failure as long as the empty primed case does not fire and the firearm can be unloaded safely after each drop
- The firearm should be tested so as to fall once on its right side and once on its left side
- The magazine or clip should be fully loaded with dummy cartridges/shotshells
- The firearm should be of minimum and maximum weight configurations for a given model, including weight variations introduced by accessories catalogued by the manufacturer
- Record findings and observations in the notes

1.6.12.5 Interpretation of Results

May determine if firearm is capable of firing when subjected to abusive mishandling. Record interpretation of results in the notes.

1.6.13 Ejection Pattern Analysis

Ejection pattern testing is another procedure performed upon request to determine the pattern produced when a cartridge case/shotshell case is ejected from a firearm during the firing process. Use the evidence firearm and

the same manufacturer and type of ammunition received from the requesting agency or the ammunition determined by the examiner from the fired ammunition components received.

1.6.13.1 Standard Ejection Pattern Test

- Fire all ejection pattern tests at the firing range
- Check the barrel for obstructions before each firing
- Shoot the tests at shoulder height
- With pistols, use the strong hand and a strong grip, with the shooting arm extended
- Measure from the ejection port to a point on the ground directly below the ejection port
- A minimum of five (5) cartridges/shotshells should be fired
- A second examiner may assist in marking the points on the ground or the floor where the fired cartridge cases/shotshell cases first land
- Measurements should be taken from the point on the ground or floor directly below the ejection port as a point of reference
- Measure from the point of reference to where each ejected cartridge case/shotshell case first lands
- The point of reference is to be used as the center position of the protractor, with the base of the protractor being in line with the barrel of the firearm
- Measure from the center point of the protractor to where each cartridge case/shotshell case first lands to determine the angle in degrees of the ejection
- Document the general direction of each ejected cartridge case/shotshell case to include the location of right or left of the shooter, and front or rear of the shooter
- Draw a sketch to illustrate the results
- Record findings and observations in the notes

1.6.13.1.1 Reporting Formats

Results should be reported in general terms unless asked by the requesting agency for more specific information. Example:

Using the item [ ] firearm and ammunition like the item [ ] cartridges or shotshells, an ejection pattern test was conducted. The item [ ] firearm was held at shoulder height (approximately 58 inches) with a firm grip in the examiner's strong hand. Fired cartridge cases or shotshell cases landed or tended to land to the right and rear of the shooter.

Examiner may include distances in the results. Example:

Using the item [ ] firearm and ammunition like the item [ ] ammunition, an ejection pattern test was conducted. The item [ ] firearm was held at shoulder height (approximately 58 inches) and fired cartridge cases/shotshell cases were ejected to the right front of the shooter at an angle of approximately 60 degrees. The distance from the ejection port of the firearm ranged from approximately 16 feet to 32 feet.

1.6.13.2 Non-Standard Ejection Pattern Test

A non-standard ejection pattern test would be appropriate when information about the conditions or situations of a shooting incident is provided by an agency that requests an ejection pattern test be

conducted simulating those conditions/situations.

- First, conduct a standard ejection pattern test
- Next, using the information provided about the conditions of the shooting incident, the examiner will devise a method to best simulate those conditions. Since the variables are infinite, no set procedures will be established for simulating these variables. It will be up to the discretion of the examiner to best determine the methodology to be used.
- Report findings and observations in the notes

1.6.13.2.1 Reporting Formats

- First, report results of a standard ejection pattern test
- Next, report the results of the non-standard ejection pattern test including an explanation of all the variables used to conduct the examination

1.6.14 Ammunition Reference Library

The Ammunition Reference Collection is defined as a collection or cataloging of ammunition and components utilized for various scientific reasons, such as:

- To identify the manufacturer's ammunition designation and source of evidence ammunition or component parts
- To provide an exemplar resource for training new forensic scientists/evidence technicians
- To provide a resource for the identification of ammunition components recovered at a crime scene or from autopsies

Space, storage containers, and computer equipment available will govern each laboratory's ammunition reference collection; however, the following should be considered:

- Use of architect blueprint cabinets, map drawers, or similar style cabinets for storage of the collection
- Use of clear plastic tubes or boxes for storage of each ammunition entry. The entry consist of at least one whole cartridge/shotshell and one cartridge/shotshell broken down into its component parts
- Recording ammunition information, such as:

  Manufacturer
  Bullet weight
  Bullet style or configuration
  Manufacturer's Index
  Headstamp
  Other pertinent information

- Catalog in storage cabinet utilizing caliber and/or other manufacturer's data as appropriate to organize
- Utilize a computer and appropriate software to track and maintain the collection

1.7 Appropriate Appendices

Appendix A – Calibration Standards

Appendix C – Worksheets

1.8 References

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